EMCON
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February 23, 1996
Project 0H93-001.006

Mr. Jim Ross
Section Chief - Site Clean Up Unit
California Regional Water Quality Control Board - Los Angeles Region
101 Centre Plaza Drive
Monterey Park, California 91754-2156

Re: File No. 95-066: Remediation Progress Update (December 1995)
Former Dial Corporation Facility
9300 East Rayo Avenue, South Gate

Dear Mr. Ross:

EMCON is providing this report summarizing the vapor extraction system (VES) operation at the referenced Dial Corporation (Dial) Facility in South Gate for the period of November 30 to December 18, 1995. The VES consists of seven vapor extraction wells (or well nests) connected to a Stealth Industries 250 cfm thermal/catalytic oxidizer (SI 250). The VES was started on January 26, 1995. The active remediation by vapor extraction and destruction by oxidation was completed on December 18, 1995.

VES OPERATIONAL DATA

The following table summarizes the monitoring data for the period.

Cumulative Operational Time (hours)/days	7,097 / 326
Percent Operational Time this Period/project	100% / 91%
Inlet TVH Concentrations (ppmv)/highest	470 / 4,500
Inlet Benzene Concentration (ppmv)/highest	ND / 52
Cumulative TVH Pounds Removed (lbs)	21,427
Cumulative Benzene Pounds Removed (lbs)	106

Since the start-up the system has operated for 326 days and has operated 7,097 hours. The SI 250 has been 91 percent operational from the start-up on January 1995. The system has operated for 18 days in this reporting period. Intake vacuums have ranged 42 inches of water (w.c.) to 82 inches w.c. as wells have been opened and closed. During this period the process flow rate extracted from the well field ranged from 40 cubic feet per minute (cfm) to 122 cfm.

The volatile organic compound (VOC) concentrations in the vapor stream are measured by a photoionization detector (PID) calibrated to isobutylene. During this reporting period VOC readings measured in the influent before dilution ranged from 312 parts per million by volume (ppmv) to 570 ppmv. Effluent VOC readings ranged from 4 ppmv to 16.7 ppmv, which is below the permitted effluent VOC reading of 50 ppmv. See Table 1 for a complete summary of the vapor extraction system operating data.

Beginning in mid-March 1995, during weekly site visits, those wells that showed poor production were shutdown to optimize recovery and to maintain an optimal mass removal rate. Wells are closed as they show declining vapor concentrations measured in the field with a photoionization detector. Wells VW-2, VW-3B, VW-4B, VW-5A and VW-5B are showing declining PID readings (50 to 490 ppmv). Since March, 1995 these wells have been periodically closed to maximize the removal of petroleum hydrocarbons from wells VW-1, VW-3A and VW-4A. Each well is monitored for oxygen, carbon dioxide, vacuum, PID readings, and vapor flow.

During August 1995, in an effort to maximize hydrocarbon extraction rates, EMCON focused extraction efforts from the remaining wells that produced the highest vapor concentrations (VW-1, VW-3A).

REPORTING PERIOD SAMPLE RESULTS

For this reporting period, one influent sample (before dilution) was collected and delivered to a state certified laboratory for analysis of volatile petroleum hydrocarbons content (C5-C12 range). The concentration of TVH as gasoline in this vapor sample was reported to be 470 ppmv (November 20, 1995). The concentration of benzene was reported as not detectable. The historic VES analytical data since startup in early 1995 is summarized in Table 2 and graphically represented in Charts 1, 2, and 3.

The certified analytical reports (CARs) for the vapor samples collected over this reporting period are presented in Attachment 1.

VAPOR EXTRACTION SYSTEM PERFORMANCE

To date approximately 21,427 pounds (lbs) of total volatile hydrocarbons (TVH) as gasoline (C5-C12 range) and approximately 106 lbs of benzene have been extracted from the wells and oxidized by the SI 250 unit in 7,097 hours of operation (Table 3, Charts 1 and 2). Over the reporting period the SI 250 operational uptime was 100 percent.

The remedial effort, including the internal combustion engine (ICE 12,847 lbs) operational in the fourth quarter of 1993 and the SI 250, has removed 34,274 lbs of TVH as gasoline. The highest TVH concentration recorded during the remedial efforts was

36,000 ppmv during the four quarters of 1993, and the latest (November 20, 1995) TVH concentration was 470 ppmv. Since the startup of the remediation system in early 1995, the concentration of benzene in extracted vapors has been reduced from 52 ppmv to not detectable concentrations (Figure 2).

FEASIBILITY OF IN SITU BIOREMEDIATION

The percent of oxygen in the subsurface vapor has shown a gradual increase since the outer wells have been open to the atmosphere. This infiltration of oxygen aids in the removal of petroleum hydrocarbons by biological remediation. The process of aerobic bioremediation appears to be occurring in the subsurface. During aerobic bioremediation, a biomass uptakes oxygen, nutrients, and the petroleum hydrocarbons to produce energy. The biomass will release carbon dioxide as a waste product. Monitoring results have shown elevated carbon dioxide and lowered oxygen readings in samples from wells VW-1, VW-2, VW-4B, and VW-5B, indicating aerobic bioremediation.

Between October 27 to November 3, 1995 EMCON performed an in-situ respirometry test at the site. This test was performed to estimate rates of destruction of petroleum hydrocarbons by in-situ bioremediation. During the test, the vapor extraction wells were periodically purged and sampled for carbon dioxide, oxygen, and VOC. Following the field work the data were evaluated to determine bioremediation activity. This data may be used to support a remedial program based on natural attenuation of hydrocarbons in the subsurface through a mechanism of intrinsic bioremediation. An option for natural attenuation may be needed, if SVE is not completely effective in removing all hydrocarbons sorbed to the soils in the area of the former garage and underground storage tanks.

The data from the in-situ respirometry test was used to calculate the oxygen utilization. The rates were calculated as percent oxygen verses time. The oxygen utilization rate was determined as the slope of the percent oxygen versus time. Zero-order respiration rates are typical. Table 4 summarizes the data from the in-situ respirometry test, and Figures 4 and 5 are graphical representations.

Biodegradation rates of petroleum hydrocarbons can be determined from the oxygen utilization rates and the stoichiometric relationship from the oxidation of hydrocarbons. Hexane is used as the representative hydrocarbon to determine the degradation rates by the following stoichiometric relationship.

$$C_6H_{14} + 9.5\,O_2 \rightarrow 6\,CO_2 + 7\,H_2O$$

Based on the utilization rates (Figures 4 and 5), the biodegradation rate was estimated by the following equation.

$K_B = -K_O * A * D_O * C/100$
where:
K_B = biodegradation rate (mg/kg day) (hexane equivalent per kg of soil per day)
K_O = oxygen utilization rate (percent per day)
A = volume of air/kg of soil (L/kg)
D_O = density of oxygen gas (mg/L)
C = mass ratio of hydrocarbons to oxygen required for mineralization

Following the in-situ respirometry test, wells VEW-1 and VW-3B were analyzed for the biodegradation rates. VEW-1 with an oxygen utilization rate of 3.12 percent per day had a biodegradation rate of 0.02 mg of hexane equivalent per 1 kilogram of soil per day. See Calculation Sheet 1. VW 3B with an oxygen utilization rate of 1.30 percent per day had a biodegradation rate of 0.01 mg of hexane equivalent per 1 kilogram of soil per day. See Calculation Sheet 2. Based on the results of the in-situ respirometry test a passive bioremediation program is an appropriate alternative for the removal of the residual hydrocarbon impacts, should additional remediation be required.

The SVE has shown a steady removal of volatile hydrocarbon compounds since startup in January 1995. Based on the declining TVH and the not detectable benzene concentrations in the extracted vapor, the SVE has achieve its engineered efficiency. On December 18, 1995, EMCON shut off the SVE because it was not cost effective in removing volatile hydrocarbons. A confirmatory soil boring program will be proposed to assess the effectiveness of the VES. Closure of the VES will be requested based on the result of the confirmatory boring program. If you have any questions or comments regarding this report please do not hesitate to call.

Sincerely,

EMCON

Gregory V. Coppola
Project Engineer

Michael E. Flack, R.G. 5473
Project Manager

Attachments: Abbreviations and Notes
Table 1 - Vapor Extraction System Operation Data
Table 2 - Laboratory Analytical Results of Extracted Vapors
Table 3 - Benzene and TVH Gasoline Mass Removal Data
Table 4 - In-Situ Respirometry Test Data
Figure 1 - TVH Concentration and Mass Removed vs. Operating Hours
Figure 2 - Benzene Concentration and Mass Removed vs. Operating Hours
Figure 3 - BTEX Concentration vs. Operating Hours
Figure 4 - VEW-1 In-Situ Respirometry Data
Figure 5 - VW-3B In-Situ Respirometry Data
Calculation Sheet 1 - VEW-1 Biodegradation Rate
Calculation Sheet 2 - VW-3B Biodegradation Rate
Attachment 1 - Certified Analytical Reports

cc: John Lang, Quantum Management Group, Inc.
Michael Cavanaugh, Dial Corp.
Jenny Au, California Regional Water Quality Control Board - Los Angeles Region

ABBREVIATIONS AND NOTES

The following is an explanation of the abbreviations and notes used in the attached tables and figures.

Abbreviations:

HRS	-	Hours
N/M	-	Not Measured
SCFM	-	Standard Cubic Feet Per Minute
in. w.c.	-	Inches of Water Column
°F	-	Degrees Fahrenheit
ppmv	-	parts per million by volume
vol %	-	percent by volume
%	-	percent
lbs	-	pounds

Notes:

(1) Cumulative Operating Hours - The Cumulative Operating Hours are the hours the SVE system has been in operation.

(2) Process Flow Rate/Total Flow Rate - Total flow and processing flow is measured by pressure flow elements. The total flow rate is the flow that enters the oxidizer. Process flow rate is the flow coming from the wells.

(3) Inlet vacuum is measured by EMCON, and represents the vacuum that is applied to the well field.

(4) Temperatures are measured via thermocouples in the Stealth unit.

(5) VOC is measured by EMCON using a portable photoionization detector.

(6) Oxygen is measured by EMCON using field instrumentation.

(7) LEL is measured by the Stealth. The MSA LEL sensor is calibrated regularly.

(8) Concentrations of specific compounds are analyzed by certified laboratories. The samples are handled under strict chain-of-custody. Please see laboratory analytical reports for specific methods and detection limits.

(9) Mass removal data is the total pounds of the constituent removed during the operation of the Stealth 250.

TABLES

Table 1
Vapor Extraction System Operating Data

In-Situ Vapor Extraction Program
Former Dial Facility
South Gate, California

1/12/96
0H93-001.006

Date	Cumulative Operational Hrs. (1)	Process Flow Rate (SCFM) (2)	Total Flow Rate (SCFM) (2)	Inlet Vacuum (in. W.C.) (3)	Exhaust Temperature (°F) (4)	Process Temperature (°F) (4)	Inlet VOC -before dilution- (ppm) (5)	Inlet VOC -after dilution- (ppm) (5)	Effluent VOC (ppm) (5)	Oxygen Level (vol %) (6)	LEL Level (%) (7)
1/26/95	0.1	258	321	11	639	688	2068	557	50.7	18.7	14.9
2/1/95	54.3	159	N/O	53	1451	1324	2500	2500	0	11	34.9
2/8/95	219.8	162	N/O	53	1342	1460	N/M	N/M	N/M	13.9	39.7
2/15/95	373.1	103	113	47	1269	1462	8910	562	23	17.5	23.5
2/22/95	539.6	120	N/O	62	1332	1448	N/M	N/M	N/M	17.2	31.8
3/1/95	701.2	47	N/O	50	1330	1448	720	560	12.5	19.2	22.1
3/6/95	748.9	108	N/O	28	1404	1460	460	400	10.6	18.9	12.9
*	750.4	95	N/O	28	1350	1460	472	408	10.2	18.7	15.6
3/8/95	797.3	152	N/O	58	1335	1552	343	510	14.6	15.9	29.2
3/14/95	936	92	154	46.2	1352	1468	885	720	20.8	17.4	24.1
3/22/95	1070.3	52	152	42.6	1340	1450	1218	932	4.6	20.4	22.8
3/28/95	1211.2	35	151	48	1311	1460	813	539	0	19.5	22
4/4/95	1378.2	44	144	46	1306	1446	880	580	20.3	19.7	14.8
4/5/95	1400.2	36	142	51	1330	1450	677	551	19.9	16.9	25.2
4/11/95	1546.2	N/M	N/O	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M
4/18/95	1712.8	N/M	N/O	N/M	N/M	N/M	N/M	N/M	N/M	N/M	N/M
5/4/95	2048.5	196	163	74	743	692	315	300	11	20.7	8.1
5/11/95	2213.2	185	147	88	803	722	286	280	18	20.9	8.9
5/18/95	2383.8	188	188	88	724	788	188	179	11.4	20.9	9
5/23/95	2502.9	130	130	69	857	874	863	859	11.6	20.9	9.5
6/2/95	2744.8	139	N/O	62	776	760	789	782	9.5	21.3	10.4
6/6/95	2842	58	N/O	34	720	702	1644	513	9.6	20.1	10.1
6/12/95	2983.8	95	154	56	707	688	1360	791	15.6	18.7	19.1
6/20/95	3172.8	85	112	92	892	893	780	79	16.4	20.9	13.7
6/26/95	3321.1	95	128	76	800	770	1724	1395	7.9	20.6	19.8
7/6/95	3556.4	130	117	53	670	658	2360	2360	20.5	20.8	14.16
7/10/95	3654.8	140	N/O	56	674	661	2230	2230	18.6	20.8	13.9
7/17/95	3823.4	142	148	58	678	664	123	123	10.3	21	14.5
7/24/95	3988.2	128	N/O	62	677	660	560	570	9.2	20.7	4.7
7/31/95	4155.4	75	140	62	689	684	870	554	6.7	21	12.8
8/7/95	4325.2	115	175	90	675	660	680	444	11.6	20.8	9.3
8/14/95	4490.9	104	164	94	674	664	660	450	11.2	18.5	10.2
8/23/95	4716.4	117	155	90	659	652	260	209	21	20.38	10.67
8/31/95	4883.2	158	212	100	595	650	566	519	8.7	19.13	15.35
9/7/95	5008.5	164	103	90	683	655	452	448	16.2	14	23.53
9/11/95	5102.6	135	N/O	92	743	731	587	553	5.1	14.47	20.92

Table 1
Vapor Extraction System Operating Data
In-Situ Vapor Extraction Program
Former Dial Facility
South Gate, California

Date	Cumulative Operational Hrs. (1)	Process Flow Rate (SCFM) (2)	Total Flow Rate (SCFM) (2)	Inlet Vacuum (in. W.C.) (3)	Exhaust Temperature (°F) (4)	Process Temperature (°F) (4)	Inlet VOC -before dilution- (ppm) (5)	Inlet VOC -after dilution- (ppm) (5)	Effluent VOC (ppm) (5)	Oxygen Level (vol %) (6)	LEL Level (%) (7)
9/18/95	5268.8	109	N/O	74	666	737	975	956	11.6	14.5	21
9/25/95	5444.1	115	N/O	82	684	779	454	390	2.3	21	13.03
10/2/95	5612.3	125	N/O	78	636	759	320	305	6.5	21.78	14.37
10/9/95	5783.2	101	N/O	86	699	801	346	335	7.6	21.4	14.96
10/16/95	5948.3	87	N/O	86	703	821	270	240	2.1	21.21	16.38
10/23/95	6114.2	114	N/O	86	709	839	240	239	3.4	21.42	16.36
11/18/95	6323.9	124	N/O	60	605	670	170.6	163.9	3.6	20.64	20.6
11/20/95	6423.2	115	N/O	60	602	670	150	148	2.8	20.45	21.56
11/27/95	6592.9	137	N/O	60	593	680	120	118	1.6	20.98	21.14
12/1/95	6684.9	122	N/O	61	613	679	394	428	16.7	20.8702	16.51
12/4/95	6760.8	82	N/O	80	650	756	482	340	12	21.1502	16.54
12/11/95	6928.7	67	N/O	82	653	765	820	570	4	20.9702	17.44
12/18/95	7097.3	40	N/O	42	562	675	510	312	4.5	21.2402	18.15

Table 2
Laboratory Analytical Results of Extracted Vapors
In-Situ Vapor Extraction Program
Former Dial Facility
South Gate, California

Sampling Date	Cumulative Operational Hrs. (1)	Process Flow Rate (SCFM) (2)	Benzene (ppmv) (8)	Toluene (ppmv) (8)	Ethylbenzene (ppmv) (8)	Total Xylenes (ppmv) (8)	Total Volatile Hydrocarbons (ppmv) (8)	C1 to C4 Hydrocarbons (ppmv) (8)	C5 to C8 Hydrocarbons (ppmv) (8)	C9 to C12 Hydrocarbons (ppmv) (8)	TVH Gasoline C5 to C12 (ppmv) (8)
2/1/95	54.3	159	52	83	31	100	460[illegible]	310	3000	1400	4400
2/8/95	219.8	162	40	81	18	105	360[illegible]	1100	2500	0	2500
3/28/95	1211.2	35	27	100	36	120	4600	100	2700	1800	4500
5/11/95	2213.2	185	10	41	23	78	2200	64	950	1200	2200
6/6/95	2842	58	16	67	41	130	3300	39	1600	1700	3300
7/6/95	3556.4	130	2	13	10	33	730	12	270	450	720
8/23/95	4716.4	117	2.3	16	13	43	11[illegible]	25	420	670	11[illegible]
10/9/95	5783.2	101	0	11	9.8	34	740	15	270	450	720
11/20/95	6423.2	115	0	5.3	5.9	18	470	11	170	290	460

Table 3
Benzene and TVH Gasoline Mass Removal Data
In-Situ Vapor Extraction Program
Former Dial Facility
South Gate, California

Sampling Date	Cumulative Operational Hrs. (1)	Process Flow Rate (SCFM) (2)	Benzene (ppmv) (8)	C5-C12 TVH Gasoline (ppmv) (8)	Benzene Mass Removed (lbs) (9)	TVH Gasoline (C5-C12) Mass Removed (lbs) (9)
2/1/95	54.3	159	52	4400	0	0
2/8/95	219.8	162	40	2500	15	1378
3/28/95	1211.2	35	27	4500	55	6519
5/11/95	2213.2	185	10	2200	81	12072
6/6/95	2842	58	16	3300	93	15232
7/6/95	3556.4	130	2	720	100	17262
8/23/95	4716.4	117	2.3	1100	104	19222
10/9/95	5783.2	101	0	720	106	20814
11/20/95	6423.2	115	0	460	106	21427

Table 4
In-situ Respirometry Test Data
Former Dial Facility
South Gate, California

	VEW-1		
Time	Carbon Dioxide	Oxygen	PID
-50.00	1.2	16.5	780
0.01	0.1	20.3	185
0.75	0.2	20.2	310
1.75	0.3	19.8	431
2.75	0.4	19.9	539
3.75	0.4	19.7	562
4.75	0.6	19.4	618
5.50	0.6	19.4	642
24.00	0.6	19.2	870
72.00	1.5	11.5	632
96.00	3	6.7	1012

Table 4
In-situ Respirometry Test Data
Former Dial Facility
South Gate, California

VEW-2

Time	Carbon Dioxide	Oxygen	PID
-50.00	0.4	19.9	13
0.01	0	20.6	6.1
0.75	0	20.7	2.4
1.75	0	20.6	6.5
2.75	0	20.8	3.5
3.75	0	20.8	4.2
4.75	0	20.6	6.2
5.50	0	20.6	7.2
24.00	0	20.4	13.8
72.00	0	20.5	8.4
96.00	0	20.7	14.9

Table 4
In-situ Respirometry Test Data
Former Dial Facility
South Gate, California

	VEW-3A		
Time	Carbon Dioxide	Oxygen	PID
-50.00	0.4	20.1	736
0.01	0	20.7	10.3
0.75	0	20.8	23.1
1.75	0	20.8	44.7
2.75	0	21	58.9
3.75	0	20.7	64.3
4.75	0	20.4	69.3
5.50	0	20.6	56.2
24.00	0	20.8	42.6
72.00	0.1	20	101
96.00	0.1	19.8	130

Table 4
In-situ Respirometry Test Data
Former Dial Facility
South Gate, California

	VEW-3B		
Time	Carbon Dioxide	Oxygen	PID
-50.00	0	20.8	362
0.01	0	20.7	4.4
0.75	0	20.8	3.3
1.75	0	20.7	11.3
2.75	0	21	6.3
3.75	0	20.7	6.9
4.75	0	20.4	7.2
5.50	0	20.7	7.8
24.00	0	20.7	6.2
72.00	0.8	16.3	23.2
96.00	1.1	16.1	31.8

Table 4
In-situ Respirometry Test Data
Former Dial Facility
South Gate, California

VEW-4A			
Time	Carbon Dioxide	Oxygen	PID
-50.00	0	20.4	13.3
0.01	0	20.6	2
0.75	0	20.7	3.3
1.75	0	20.7	7.1
2.75	0	20.9	5.9
3.75	0	20.8	3.4
4.75	0	20.3	3.8
5.50	0	20.8	4.2
24.00	0	20.7	6.2
72.00	0	20.4	13
96.00	0	20.2	8.6

Table 4
In-situ Respirometry Test Data
Former Dial Facility
South Gate. California

VEW-4B

Time	Carbon Dioxide	Oxygen	PID
-50.00	0	20.6	7.7
0.01	0	20.7	2.2
0.75	0	20.7	2.5
1.75	0	20.7	3.8
2.75	0	20.9	2.2
3.75	0	20.8	2.2
4.75	0	20.2	2.2
5.50	0	20.7	2.2
24.00	0	20.7	4.8
72.00	0	20.6	6.9
96.00	0	20.6	9.8

Table 4
In-situ Respirometry Test Data
Former Dial Facility
South Gate, California

VEW-5A

Time	Carbon Dioxide	Oxygen	PID
-50.00	0	20.5	2.2
0.01	0	20.7	4
0.75	0	20.7	4.5
1.75	0	20.8	7.3
2.75	0	21	5.4
3.75	0	20.9	4
4.75	0	20.6	4.8
5.50	0	20.6	5.3
24.00	0	20.6	6
72.00	0	20.5	6
96.00	0	20.5	11.2

Table 4
In-situ Respirometry Test Data
Former Dial Facility
South Gate, California

VEW-5B

Time	Carbon Dioxide	Oxygen	PID
-50.00	0	20.7	7.9
0.01	0	20.6	4.6
0.75	0	20.8	5.3
1.75	0	20.8	8
2.75	0	21	7.6
3.75	0	20.9	8.2
4.75	0	20.6	10.3
5.50	0	20.6	10
24.00	0	20.6	8.2
72.00	0	20.2	7
96.00	0	20.2	11.4

FIGURES

2/1/96
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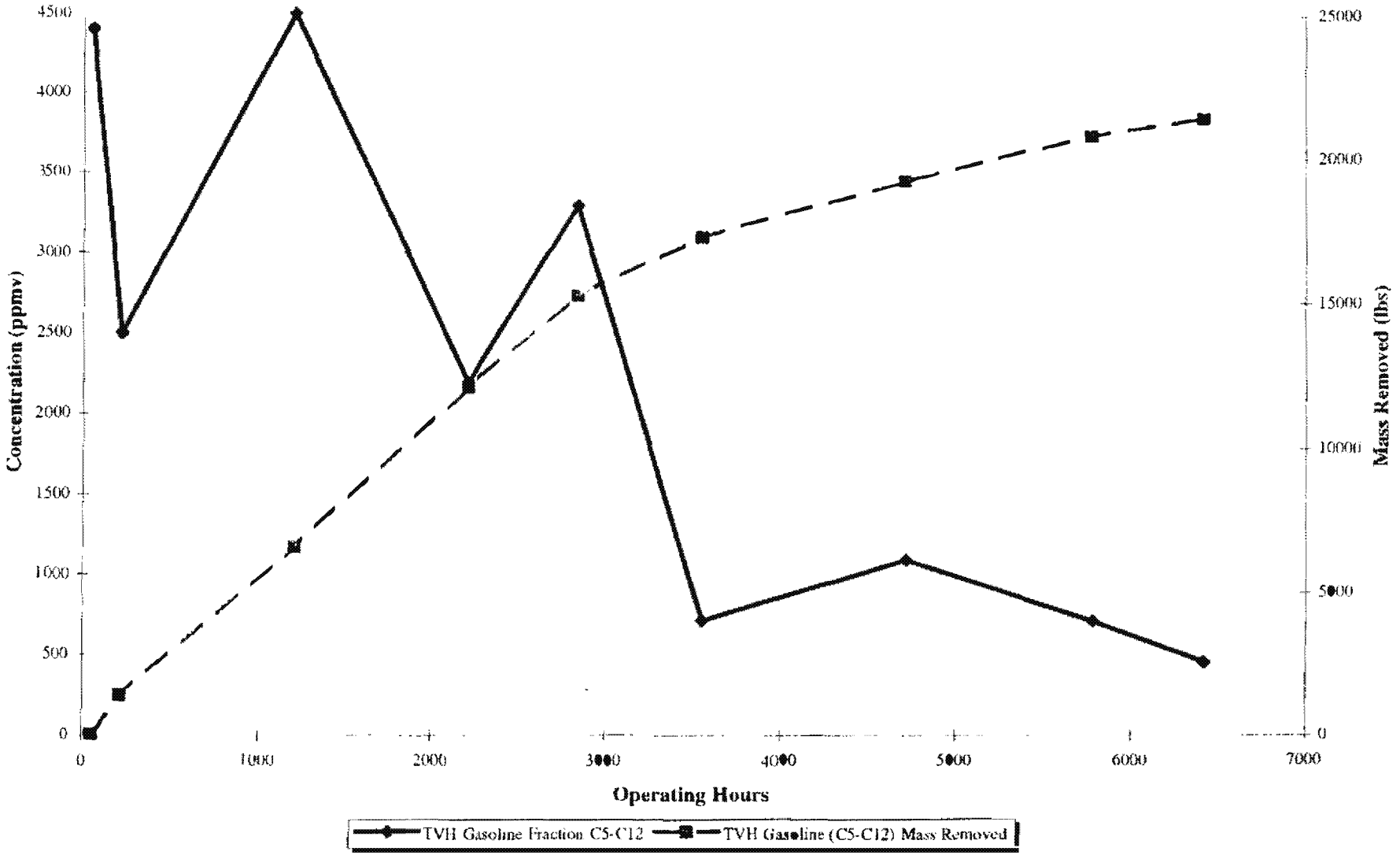
Figure 1
TVH Concentration and Mass Removed vs. Operating Hours

In-Situ Vapor Extraction Program
Former Dial Facility
South Gate, California



2/1/96
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Figure 2
Benzene Concentration and Mass Removed
vs. Operating Hours
In-Situ Vapor Extraction Program
Former Dial Facility
South Gate, California

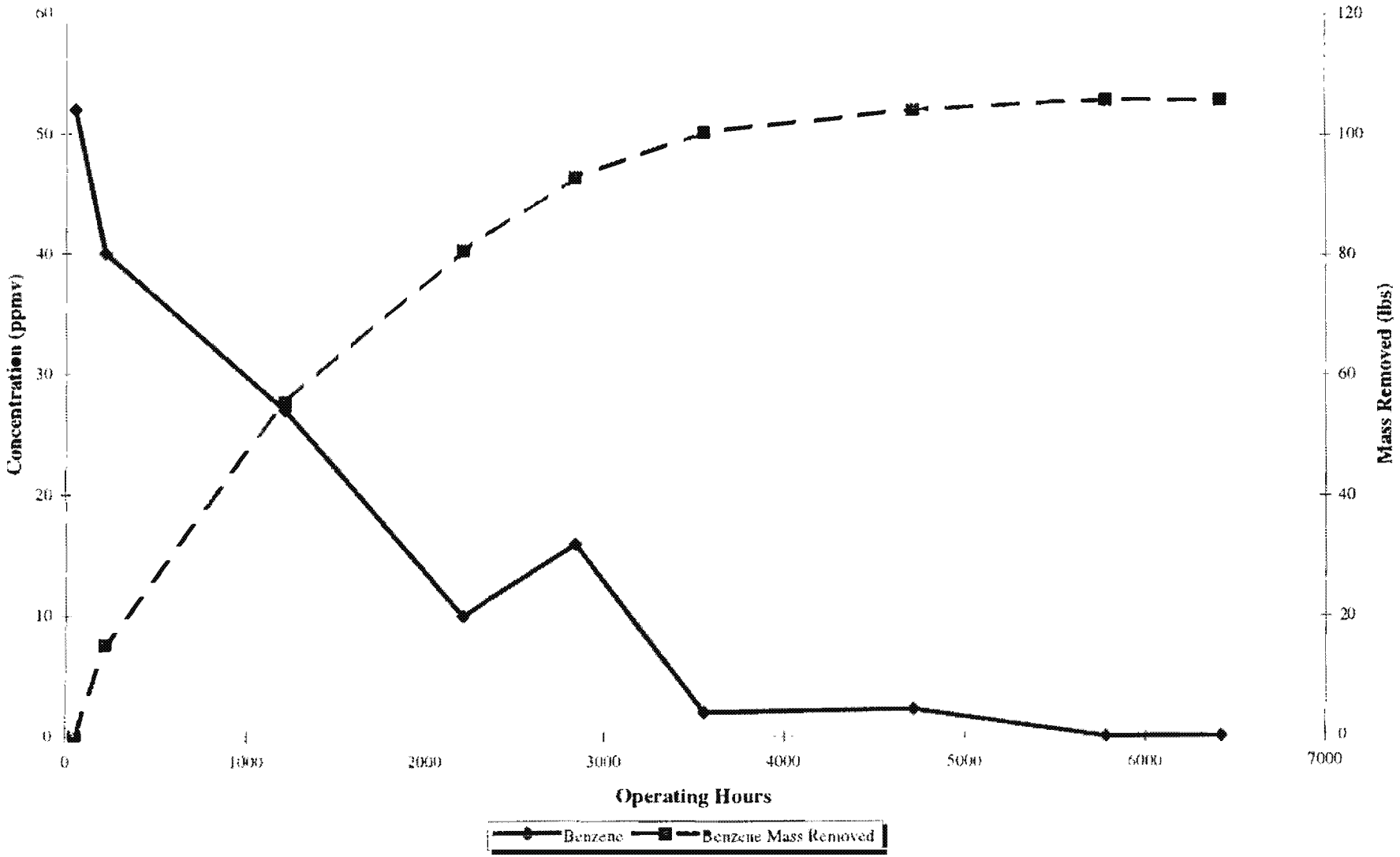


Figure 3
BTEX Concentration vs Operating Hours
In-Situ Vapor Extraction Program
Former Dial Facility
South Gate, California

2/1/96
OH93-001.006

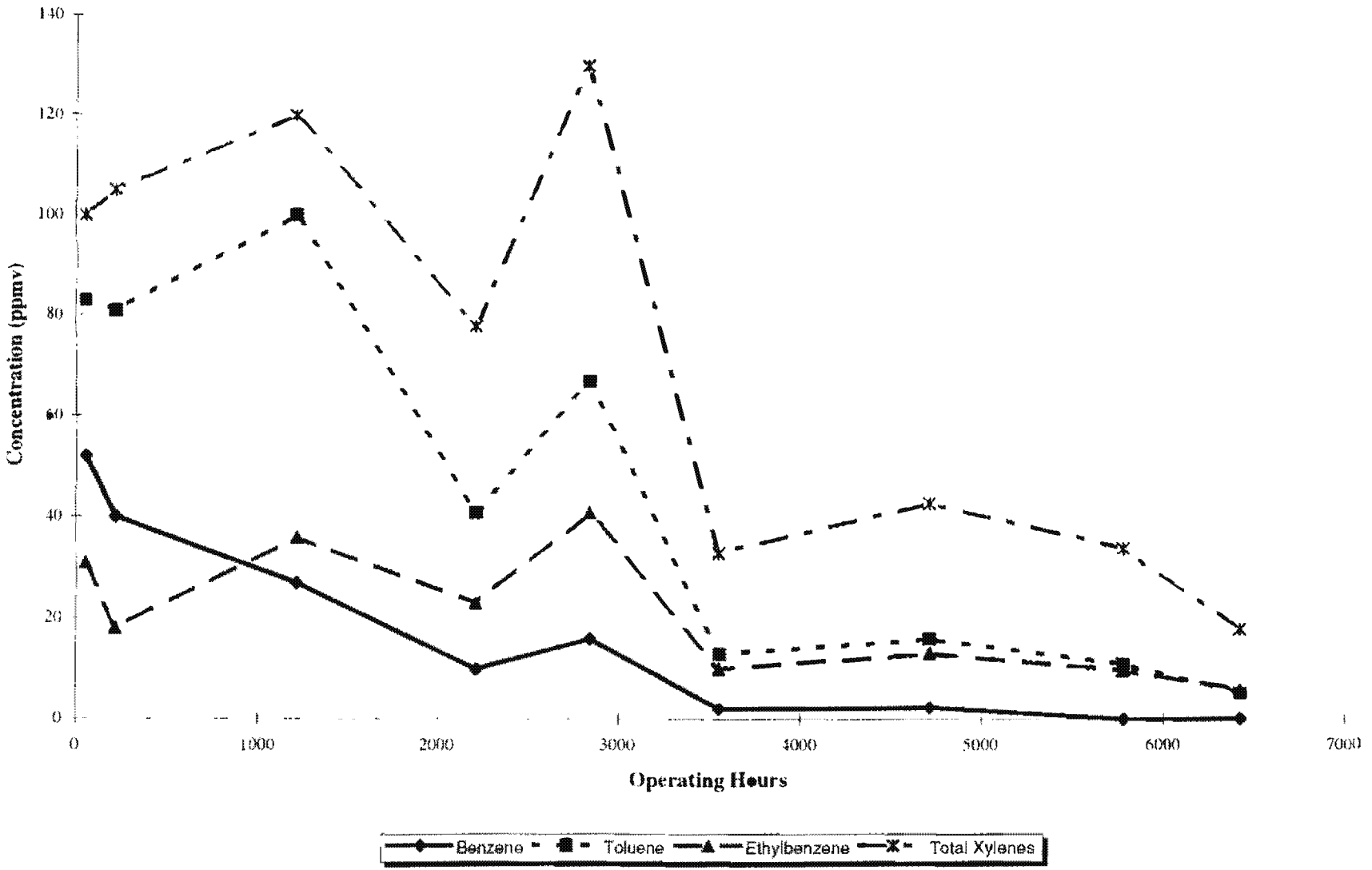


Figure 4
In-Situ Respirometry Test Data VEW-1
Former ■ial Facility
South Gate, California

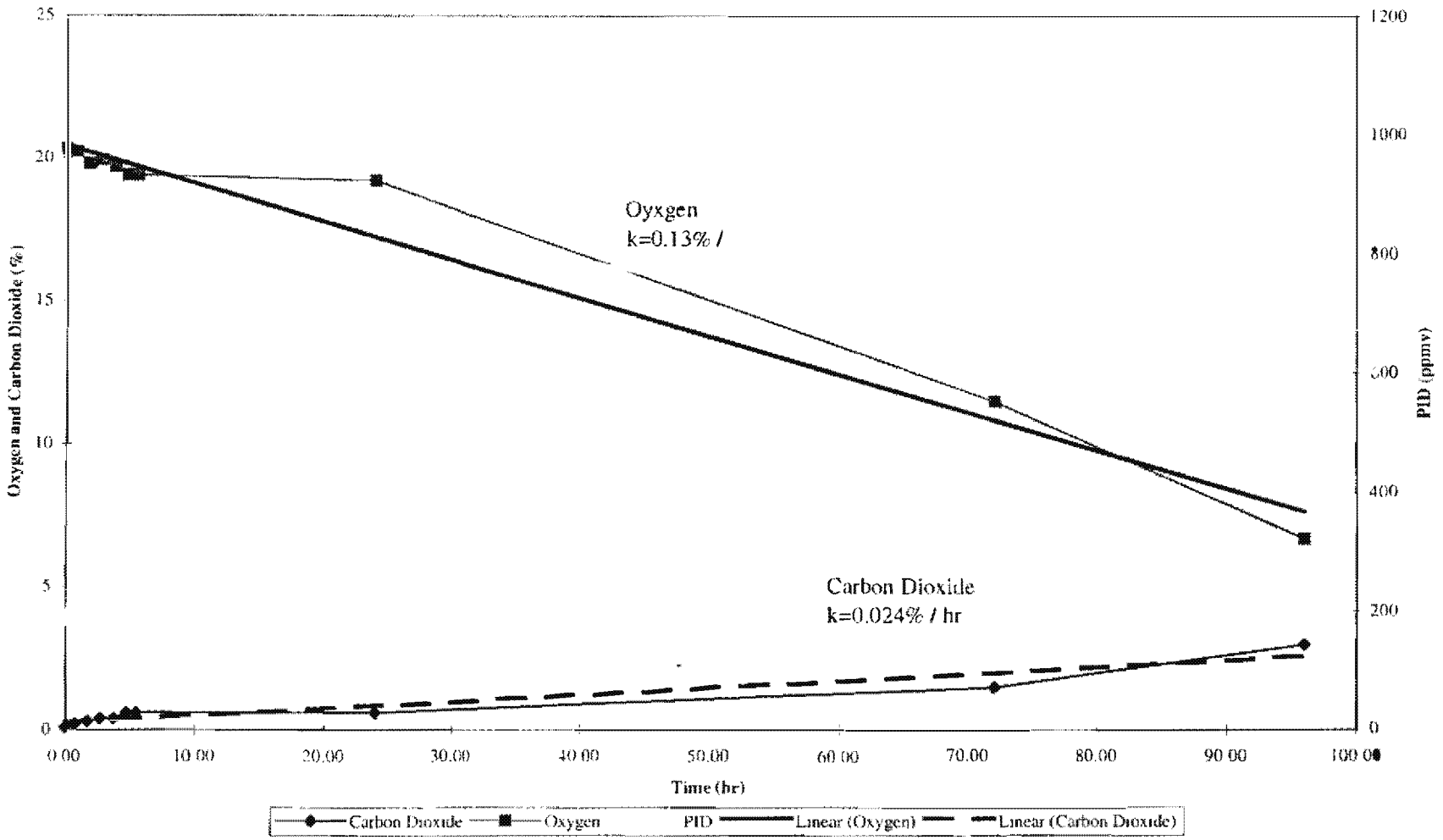
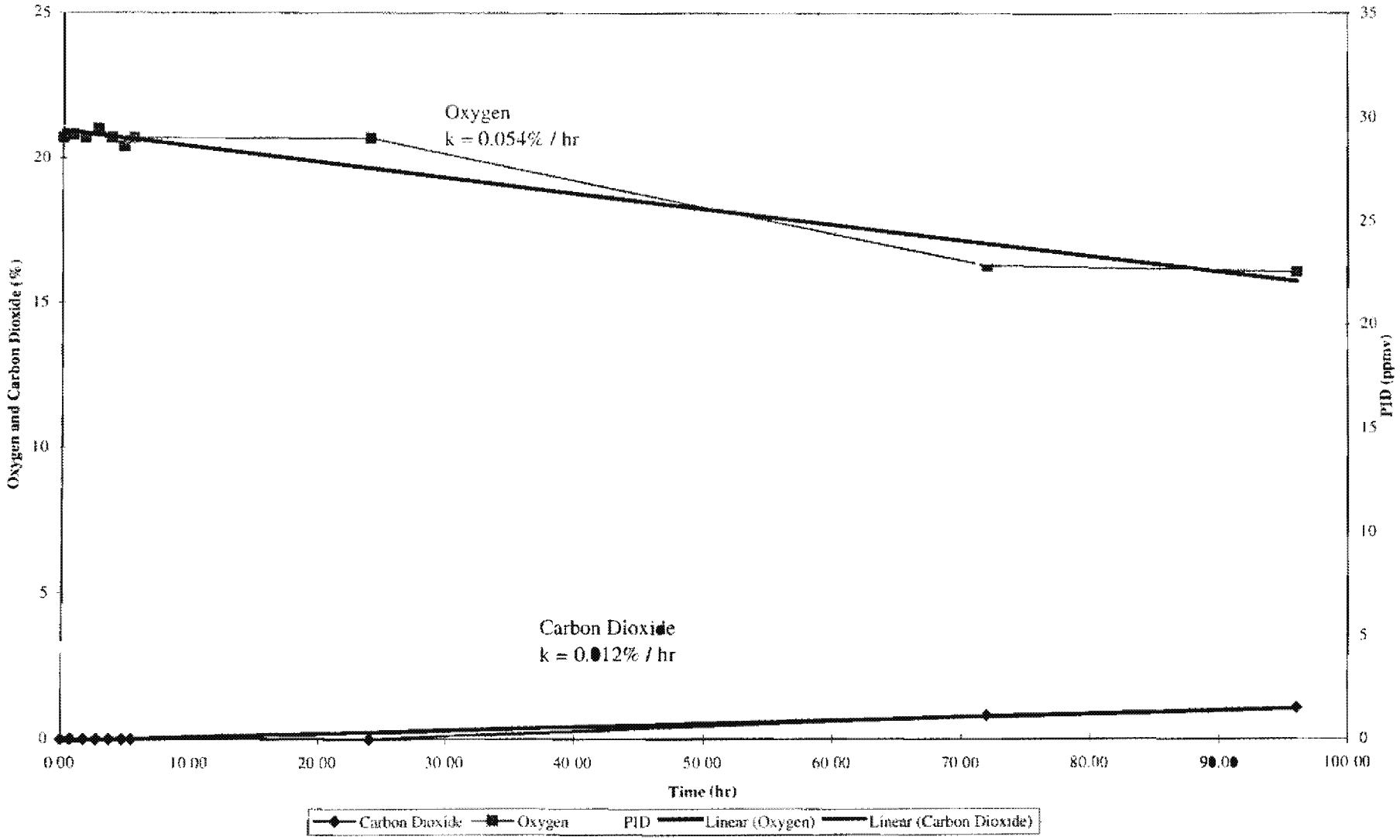


Figure 5
In-situ Respirometry Test Data VW-3B
Former Dial Facility
South Gate, California



CALCULATIONS

Calculation Sheet 1
VEW-1

Calculate biodegradation rates using oxygen utilization rates:

Assumptions:

- Hexane will be representative hydrocarbon
- Porosity is 0.3
- Soil bulk density is 1440 kg/m^3
- Oxygen atomic mass is 16; Carbon atomic mass is 12; Hydrogen atomic mass is 1
- Stoichiometry relation for degradation is

$$C_6H_{14} + 9.5\ O_2 \rightarrow 6\ CO_2 + 7\ H_2O$$

Based on utilization rates of oxygen and the generation rates of carbon dioxide, biodegradation rates in terms of mg of hexane equivalent per kg of soil per day.

$$K_B = -K_O * A * D_O * C / 100$$

Where

- K_B = Biodegradation rate in (mg/kg/day)
- K_O = Oxygen utilization rate (% per day)
- A = Volume of air per kg of soil (l/kg)
- D_O = Density of oxygen gas (mg/l) = 1.330 mg/l
- C = Mass ratio of hydrocarbon to oxygen required for mineralization = 3.5 based on hexane mineralization

Calculation

K_O = 0.13 % / hr * 24 hr/day = 3.12 % / day

A = Porosity / bulk density = 0.21

K_B = 3.12 %/day * (0.21) * (1330) * (1/3.5) / 100

K_B = 8.02 mg/kg/day

Calculation Sheet 2
VW-3B

Calculate biodegradation rates using oxygen utilization rates:

Assumptions:

- Hexane will be representative hydrocarbon
- Porosity is 0.3
- Soil bulk density is 1440 kg/m^3
- Oxygen atomic mass is 16; Carbon atomic mass is 12; Hydrogen atomic mass is 1
- Stoichiometry relation for degradation is

$$C_6H_{14} + 9.5\ O_2 \rightarrow 6\ CO_2 + 7\ H_2O$$

Based on utilization rates of oxygen and the generation rates of carbon dioxide, biodegradation rates in terms of mg of hexane equivalent per kg of soil per day.

$$K_B = -K_O * A * D_O * C / 100$$

Where

- K_B = Biodegradation rate in (mg/kg/day)
- K_O = Oxygen utilization rate (% per day)
- A = Volume of air per kg of soil (l/kg)
- D_O = Density of oxygen gas (mg/l) = 1,330 mg/l
- C = Mass ratio of hydrocarbon to oxygen required for mineralization = 3.5 based on hexane mineralization

Calculation

K_O = 0.054 % / hr * 24 hr/day =1.30 % / day

A = Porosity / bulk density = 0.21

K_B = 1.30 %/day * (0.21) * (1330) * (1/3.5) / 100

K_B = 0.01 mg/kg/day

ATTACHMENT 1

CERTIFIED ANALYTICAL REPORTS

EMCON
3300 N. San Fernando Boulevard•Burbank, California 91504 • **(818)841-1160** • Fax (818)846-9280

TRANSMITTAL

Project/Task No.: 0662-001.26

TO: Jim Ross
RWQCB-Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754

DATE: March 12, 1996

RE: Transmittal of errata pages 21 and 25 and Figure 10 from Groundwater Monitoring Report 1994 Annual and First Quarter 1995

WE ARE SENDING:

QUANTITY	DESCRIPTION
1	1 copy of Pages 21 and 25 and Figure 10 from Groundwater Monitoring Report 1994 Annual and First Quarter 1995

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x	INFORMATION		COURIER
	OTHER		OTHER

COMMENTS: An error was found in the total mass of TCE and chromium removed calculations for the above mentioned report. Please remove pages 21 and 25 and Figure 10 from this report and replace them with the corrected pages 21 and 25 and Figure 10. If you have questions or require further information, please do not hesitate to call Donald Marcus or Sally Bildeau at (818) 841-1160.

CC: Phil Chandler, DTSC, Glendale
Scott Simpson, DTSC, Glendale
Susan Salinas, Teleflex

BY: Chris L. Bonds

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5.6.2 Mass Reduction Calculations for TCE and Chromium

The total volume of groundwater extracted during 1994 was 19,042,270 gallons. The largest volume of groundwater extracted during 1 month was 1,989,470 gallons in November. The least amount of groundwater extracted during 1 month was 765,010 gallons in September. The volume of water extracted in September was below normal because of a planned 2-week shutdown of the treatment system for coating of the bermed area. Monthly groundwater extraction and the cumulative total have been graphed (see Figure 9).

Based on the total gallons of groundwater extracted, and the approximate area and thickness of the TCE and chromium plumes, approximately 14.3 percent of the TCE plume pore volume and 47.3 percent of the chromium plume pore volume were extracted during 1994. A pore volume of 2 percent was used to calculate these percentages.

The mass removal of TCE and chromium was calculated using the quarterly influent groundwater TCE and chromium data multiplied by the total liters of groundwater processed at the treatment facility. Approximately 90 kilogram (kg) of TCE and 11 kg of chromium were removed during 1994 (see Figure 10).

An increasing chromium trend was confirmed in downgradient unweathered zone extraction well E-33, suggesting that it is successfully capturing more impacted water from upgradient areas.

Decreasing TCE and chromium trends were confirmed in well E-6, suggesting that E-6 effectively removes both contaminants from the aquifer in its vicinity. A decreasing chromium trend was noted in extraction well E-23 and monitoring wells E-13, E-14, E-24, E-31, E-35, E-36, and E-38. This decrease suggests that dissolved chromium is being removed from the aquifer.

6.4 QA/QC Analysis

The TCE analytical variance noted in the results of the duplicate analysis of well E-2 (46.3 percent) suggests that the sample was not homogeneous. Sample inhomogeneity is a commonly reported problem in wells containing high concentrations of TCE.

All of the duplicate samples analyzed for metals showed acceptable levels of variance for concentrations of selected metals in February 1995.

All other QA/QC results were within acceptance standards, except three surrogate recoveries. The chemists narrative states that the data was not compromised by the occurence.

6.5 Extraction and Treatment System Performance

The 1994 average rate of pumping was 1.59 million gallons of groundwater per month, a decrease from the 1993 average of about 2 million gallons per month. The decrease throughput in 1994 is considered a result of a combination of drawdown of the aquifer and periodic nonoperation of the system for upgrades, maintenance, and repairs.

Despite the repairs and maintenance, the TCE and chromium plumes have changed little during the period. This indicates that effective plume control is being maintained even though pumping has decreased from 1993 levels.

The concurrent decreases in the water levels and general decreases in TCE and chromium concentrations noted during the 1994 period suggest that the expanded groundwater extraction system is both progressively dewatering the aquifer and reducing the dissolved mass of the TCE and chromium plumes. An estimated 90 kg (198 pounds) of TCE and 11 kg (24 pounds) of chromium were removed during the year, the result of extracting approximately 14.3 percent of TCE plume pore volume and 47.3 percent of chromium plume pore volume during 1994. As stated a pore volume of 2 percent was used to calculate these percentages.

Figure 10
TCE and Chromium Mass Removed During 1994